ASTERIX

The development of neutron spin and sample excitation correlation techniques is essential for understanding a wide range of magnetic and related electron transport problems in the emerging class of complex materials, including, for example, nanostructure-engineered and adaptive materials. A detailed understanding of complex materials requires studies that use neutron beams to characterize the exotic magnetic and atomic structures of these materials under extreme conditions of high-magnetic fields, high pressures, and very low temperatures. The first objective of this project was to understand the complex instrumentation issues involved in extracting a polarized neutron beam from a pulsed neutron source and propagating the beam through magnetic field gradients that vary in space and time. A second objective is to develop a solution to the polarization problems, e.g., beam splitting (the Stern-Gerlach effect), associated with interactions between (polarized) neutron beams and the equipment (in this case the high-field magnets) used to produce a variety of extreme environments simultaneously. The solution of this problem enables unique studies of complex materials.

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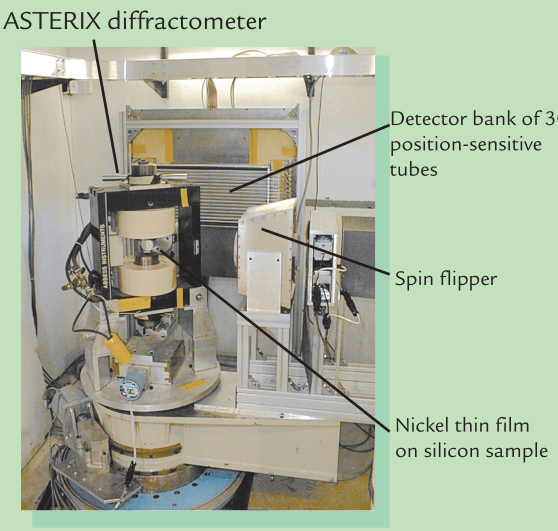
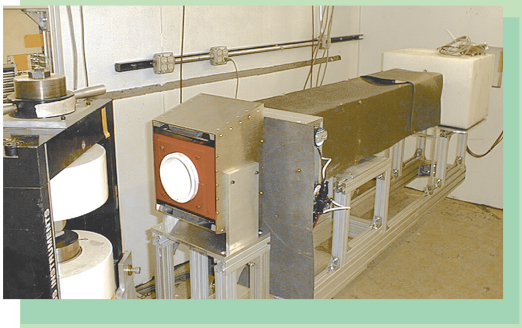
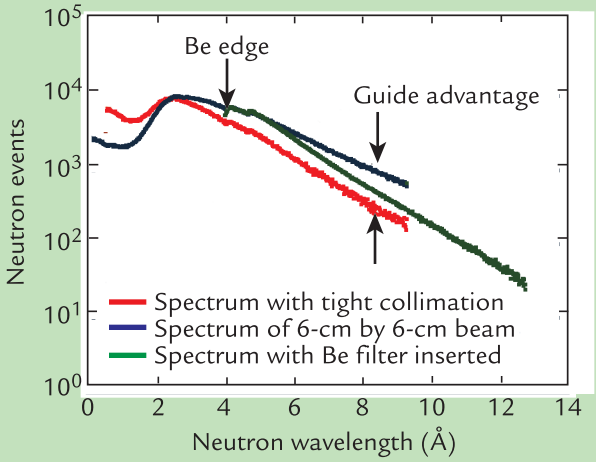
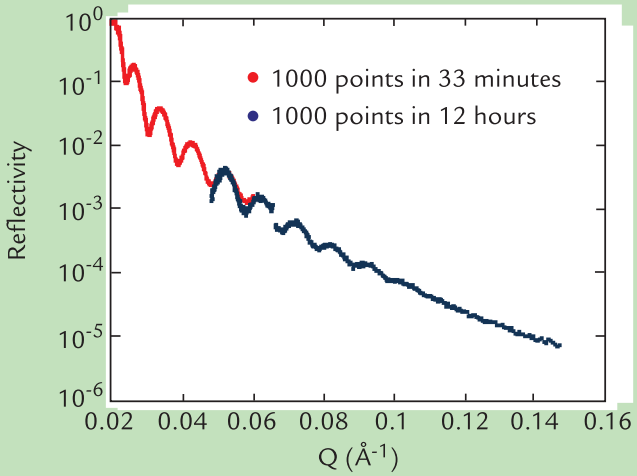




View of the position-sensitive neutron detector, the polarization analyzer, the slits, and the spin flipper.



Variation of spectra measured for ASTERIX under different measurment conditions, including (1) tight collimation, (2) without slits in the neutron beam, and (3) with a beryllium filter.



Reflectivity profile of a thin nickel film grown on a 5-cm-diam silicon substrate.